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Towards Generating Narratives for the Real World

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Introduction

An immersive, interactive environment and the non-player characters (NPCs) populating it often play a key role in interactive narrative experiences. The advent of augmented reality (AR) devices and the popularisation of live interactive narratives, has opened up the arena in which these narratives are played out, extending them from virtual worlds to the real world (Bolter and MacIntyre 2007; Dow et al. 2006; OpenAI 2017; MIT Technology Review 2016). Various research groups prefer such open world simulations since the simulation gives them a realistic, detailed world to test their algorithms and training models.

I argue that if the virtual model of the world is better able to reflect the player's surroundings, then their narratives would be more "transportive" for their users. AR is a useful mechanic for this, providing both explicit and direct interaction with foreground information, as well as for implicit and passive interaction with background information (MacIntyre and Mynatt 1998). With this comes the problem of generating believable narratives for an open, complex, real world. Murray and Murray argue that, in the future, *authors would be challenged to create rules for the space of interaction*, rather than the narrative itself. These rules would transform the interactor from a merely receptive reader and would instead promote a more immersive and reactive storytelling experience (Murray and Murray 2017). I am interested in understanding how the NPCs populating such a world undertake decisions, interact, and communicate their knowledge with one another in this arena. Simulating such a society within the constraints of the real environment, and allowing for NPCs to more accurately mimic human behavior could increase the believability of the agents, afford increased immersion and entertainment for the player.

Related Work

PCG research has long been used to craft narratives in virtual environments without the need for a human designer. Typically these narratives involve an AI with perfect knowledge of the story world (Aylett, Dias, and Paiva 2006; Meehan 1976) and all possible interactions within it. For complex systems like the real world, it is impossible to encode every detail of the world, and its virtual population will have imperfect and incomplete knowledge of the same. This poses several unsolved research problems in the computer science domain since unlike in virtual environments, the designer or AI does not have absolute control over the environment.

Towards this goal, prior work has dealt with manually authored AR narratives based in the world to document cultural heritage and community-based narratives or goals (Speiginer et al. 2015; Söbke, Hauge, and Stefan 2017). Macvean et al. (2011) proposed to adapt an augmented reality game authored for one city to another city by using a location translation process. Narratives have been generated by spawning arbitrary geolocations around the player for their NPC characters or events during launch (Leino, Wirman, and Fernandez 2008). Narratives have been manually generated around specific locations in mind (Dow et al. 2006). Finally, work has been done in generating narratives using the player's motion data from the mobile accelerometer (Southerton 2013). In contrast, I aim to generate a narrative specific to the player's location.

I am interested in how the uncertainties of the real world can be accounted for in the narratives generated by the AI. With prior work, I have examined the problem of mapping the "spatial uncertainty" of the player's immediate environment, and the player's preferences into platformer levels. I have also examined how "temporal uncertainty" in player movement could be handled by scheduling interactive narratives and the non-linear plot choices that accompany them, whilst taking into account the availability of real-world resources such as actors, or location availability.

With my current research, I hope to extend this work to examine how PCG can generate immersive, and transportive narratives, taking into account the constraints and spatial relationships of the locations around the unique location of the user.

Approach and Current Status

The problems described above both pertain to the theme of designing simulations and narrative generation algorithms that account for real-world, localization information. My first goal is to model a virtual world tailored uniquely to the players' surrounding. Next, to populate this world with NPCs that demonstrate believable interactions in this world.

Finally, I would tackle the problem of narrative generation within these constraints and parameters, and examine their role in creating a more pervasive experience.

Virtual World

I have started building a *textually mediated* model of the world using geolocation data from OpenStreetMaps (OSM) to identify potential points of interest (POIs). I chose OSM due to the rich, annotated dataset available to us. For large, and complex worlds it is impossible to encode every detail of the world. Additionally, it would be impossible to take every aspect of the world into account during narrative generation. The data collected from OSM include the following:

- Roadways:
  - Categories: residential, cycleways, pedestrian, paths.
  - Relationships: road intersections, building connected
- Buildings:
  - Category: residential, commercial, educational (e.g., schools, universities, or libraries), industrial (e.g., offices, or warehouses) places of worship (e.g., churches, mosques, temples, or synagogues), and civic buildings (e.g., hospitals, or stadiums).
  - Relationships: aggregation of buildings (e.g., a shopping mall may be an aggregate of the individual stores inside), building entrances as connected to roads

Virtual Characters

The idea of believability of virtual characters has long been studied and explored in art (Thomas, Johnston, and Rawls 1981) and literature. Yannakakis posited that there are four big areas of research within video game AI: player experience modeling, procedural content generation (PCG), data mining of game information, and improving non-player character behaviors and capabilities (Yannakakis 2012). This research falls into the final category. Specifically, I am interested in generating characters that can have both *spatial interactions* based on the world around them, and *social interactions* with one another and the players inhabiting their world, to understand how these factors could affect the believability of characters.

Spatial Interactions One way to target believability and realism of the NPCs include the generation of the interactions that can be undertaken in the space. For instance, NPCs in Raleigh, North Carolina, may go to work (in the Research Triangle), attend school (at NC State University) or hire a neighborhood service (food delivery from a restaurant nearby) – whilst interacting with one another (Ryan et al. 2015). We hope to conduct a user study in the future that attempts to understand the granularity of interactions that players expect from fictional virtual characters interacting with their specific surroundings. Once the simulation is complete, an additional quest generator could be added to give the player a goal within this game world.

Social Interactions A second approach I am currently undertaking has approached the generation of these NPCs while experimenting with how they respond to cultural, group or societal archetypes and opinions (Zyda et al. 2010; Wang, Huang, and Sun 2014; Tanenbaum, Seif El-Nasr, and Nixon 2014) around them. Group formation has been studied in depth by social scientists, historians, commissions, and psychologists. Within the entertainment and narrative field, generated NPCs typically do not conform to studied theories, instead acting on individual preferences. However, in the real world, simply reading the news allows one to gain a perspective of groups assembling in virtual or physical locations to support various issues. One article may describe how the *Scottish* voted to "remain" in the Brexit vote (Brooks 2016), in another we hear of *Whovians* that approve or condone representation of women in Doctor Who (Jowett 2014). Latour discusses how individuals relating to one group or another is an ongoing process made up of uncertain, fragile, controversial and ever-shifting ties (Latour 2005). This research could allow for belief and opinion modeling of NPCs where interactions amongst agents could increase the knowledge of their component agents.

Narrative Generation

Once the dataset has been collected, and the game world generated, the problem then becomes that of generating *quests for open worlds*, where the possible player interactions depend on the state and layout of the virtual world generated around the player. For instance, quests can be generated taking into account spatial progressions or by adding virtual objects to a previously generated game world. A PCG example for the same could be exploring the NC State school campus after hours, and interviewing virtual students or staff could yield clues towards solving a murder mystery.

Whether in paper, real or digital form, most stories hinge upon movement. For instance, the reader flipping through pages in a Choose Your Own Adventure book (Kraft 1981), or choice of 'rooms' to explore in a virtual adventure game (Black 2012). An example of such a 'movement' in the real world could be described as a choice of the player to walk down one of two possible roadways. Thus, one possible experiment could be to test the expressive nature of the narratives generated by having story choices that branch with the roadways. A player choosing to walk down a specific path could then change the outcome of the narrative.

Conclusion

Modeling the virtual world and narrative to reflect the player's surroundings closely has the potential to lead to more entertaining and transportive gameplay. The interactions amongst these agents sharing their cultural views, biases, and histories could inform the study of audience modeling and machine enculturation, allowing computers to learn or reason about social norms in regions. Finally, I believe this research would afford better applications in the field of entertainment, or computational social science.

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